

1 29. (Newly presented) The lithium polymer secondary battery of claim
2 28 in which the ceramic material is Al_2O_3 .

1 30. (Newly presented) The lithium polymer secondary battery of claim 29
2 in which the positive electrode comprises LiCoO_2 or V_6O_{13} .

REMARKS

Amendments

The specification has been amended to correct an obvious typographical error.

All the claims in the application have been cancelled and replaced with newly presented claims 16-30.

Support for newly presented independent claim 16 is found in original claim 1; page 8, lines 196-199; page 7, line 181, to page 8, line 189; page 7, lines 173-180; and page 5, lines 109-110 and 116-117, and Example 1, page 9, line 237, to page 10, line 248, in which the gel polymer electrolyte does not comprise ceramic particles.

Support for newly presented independent claim 22 is found in original claim 13; page 7, lines 173-180; and Example 8 and Figure 7, in which separator 15 is disclosed and on page 16, lines 420-423.

Support for newly presented independent claim 26 is found in original claim 1, page 8, lines 196-199; page 7, line 181, to page 8, line 189; page 7, lines 173-180; and page 5, lines 109-110 and 116-117, and Example 7, in which the positive electrode, negative electrode, and the polymer electrolyte contain ceramic material.

Support for newly presented dependent claims 17, 23, and 28 is found in original claim 2 and on page 29, lines 755-757. Support for newly presented dependent claims 18, 20, 24, and 29 is found in original claim 15 and in Example 1. Support for newly presented dependent claims 21, 25, and 30 is found on page

29, lines 747-750. Support for newly presented dependent claim 27 is found page 7, line 181, to page 8, line 189.

Pending Claims

All the claims pending in the application have been cancelled and replaced with newly presented claims 16-30. There are three independent claims, claims 16, 22, and 26.

Claim 16, and the claims directly and indirectly dependent thereon, recite a lithium battery in which the battery comprises a gel polymer electrolyte does not comprise ceramic material. The gel polymer electrolyte should not be confused with polymer electrolyte, which may be present in the electrodes. Referring, for example, to Figure 1, negative electrode 1 is lithium metal. Reference numeral 2 is a gel polymer electrolyte layer. The positive electrode is made up of aluminum current collector 4 and a layer of polymer electrolyte 3, which comprises ceramic particles. Fabrication of the battery represented in Figure 1, is exemplified in Example 1. These claims replace claims 1, 2, 5, 7, 8, 10, and 12, but an additional limitation that the gel polymer electrolyte does not comprise a ceramic material, has been introduced.

Claim 22, and the claims directly and indirectly dependent thereon, recite a lithium battery in which the battery comprises a separator between the positive electrode and the negative electrode. These claims replace claims 13 and 15, but an additional limitation that the battery comprises a separator, has been introduced.

Claim 26, and the claims directly and indirectly dependent thereon, recite a lithium battery in which the positive electrode, the negative electrode, and the gel polymer electrolyte each comprise ceramic particles. These claims do not replace any of the previous claims.

First Rejection under 35 U.S.C. 103(a)

Claims 13 and 15 were rejected under 35 U.S.C. 103(a) as being unpatentable over Peled, WO 94/24715 ("Peled").

Claim 13 and 15 have been cancelled and replaced with claims 22-25. Claim 22 recites "a separator between the positive electrode and the negative electrode." This feature is not disclosed by Peled. Peled discloses composite solid electrolytes for use in electrochemical cells. Peled, page 1, lines 7-12. He does not disclose or suggest a battery with a separator between the positive and negative electrode. Because, Peled uses a solid electrolyte, addition of a separator to his battery would be unnecessary.

Nothing in Peled would motivate a person of ordinary skill in the art to prepare a battery with comprising a separator between the positive and negative electrode. Rejection of claims as unpatentable over Peled has been overcome.

Second Rejection under 35 U.S.C. 103(a)

Claims 1, 2, 5, 7, 8, 10, and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Peled in view of Kawakami, U.S. Patent 5,888,666 ("Kawakami"). Claims 1, 2, 5, 7, 8, 10, and 12 have been cancelled and replaced with claims 16-21.

The Office asserts that polyethylene oxide (PEO) is an inherently gelled material and relies on Kawakami to support this assertion. Paper 11, page 4, lines 7-10. The Office also asserts that the solid electrolyte of Peled, which comprises polyethylene oxide, is a gel. Paper 11, page 5, lines 8-9. These assertions are respectfully traversed.

Applicants assume that the Office relies on column 9, line 43, to column 10, line 5, which recites a long list of polymers. However, attention is directed to column 10, lines 6-64, in which methods that can be used to convert these polymers to gels are disclosed. Attention is further directed to column 9, lines 43-46, which discloses that a gel is "a polymer having a three-dimensional network structure which is insoluble in a solvent, or a material which swells by absorbing a solvent." (emphasis added)

Attention is further directed to the six R.I.T.A. Corporation Technical Data Sheets for polyethylene oxides of varying molecular weight, copies of which are enclosed. These data sheets are available from the Internet at "ritacorp.com". The

Polyethylene oxide products listed vary in molecular weight from 210,000 (Rita PEO-1) to 7,200,000 (Rita PEO-27). Under "DESCRIPTION," each of these products is reported to be a water soluble polymer. Attention is also directed to Example 1 of Choi, U.S. Patent 5,001,036, a copy of which is enclosed for the Examiner's convenience, in which an aqueous solution comprising Polyox® WSRN 3000 (polyethylene oxide having a molecular weight of 400,000) was prepared, and to Example 13, in which a solution of Polyox® WSRN 3000 in methylene chloride was prepared.

Attention is further directed to Peled, Example 3, in which it is reported that "The casting slurry contained: 336 mg of LiI; 115 mg PEO (MW 100,000) and 115 mg PEO (MW 5,000,000) . . ." These molecular weights are less than 7,200,000. As noted above, polyethylene oxides with molecular weights up to at least 7,200,000 are water-soluble polymers.

Kawakami teaches that a gel is insoluble. However, polyethylene oxide is a well-known water-soluble polymer. The polyethylene oxides used by Peled are water-soluble polymers. Therefore, contrary to the Office position, polyethylene oxide is not a gel, and the solid electrolyte of Peled is not a gel.

If the Office position that polyethylene oxide is a gel is maintained in the next communication, the Examiner is respectfully requested to support this position by placing on the record a copy of a reference generally accepted in the field of polymer chemistry, such as a handbook, textbook, or treatise, or to place on the record an affidavit under 37 C.F.R. § 1.104(d)(2). If the Office fails to support its position in the next communication, it will be taken as an admission by the Office that this position is incorrect and has been abandoned.

Further, the solid electrolyte of Peled comprises non-conductive oxide particles. Applicants' claims now recite that the gel polymer electrolyte does not comprise a ceramic material. Nothing in Peled would motivate the person of ordinary skill in the art to omit the oxide particles because Peled teaches that the oxide particles are an essential component of the electrolyte. Page 7, lines 18-19.

As discussed above, Peled does not teach a battery comprising a gel. Peled does not disclose or suggest a solid electrolyte that does not comprise ceramic particles. Rejection of claims as unpatentable over Peled in view of Kawakami has been overcome.

Third Rejection under 35 U.S.C. 103(a)

Claims 1, 2, 5, 7, 8, 10, and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Peled in view of Blonsky, 5,648,011 ("Blonsky").

Blonsky discloses gelled electrolytes that comprise inorganic oxygen compounds such as silica, titania, alumina, magnesium oxide, and barium oxide. Abstract. The function of the gelling agent is to "absorb the liquid electrolyte." Abstract, lines 9-11, and column 4, lines 58-60. Blonsky does not disclose an electrode that comprises ceramic material. Further, the person of ordinary skill in the art, having the advantage of the teachings of Blonsky would not be motivated to put ceramic material in the electrode or to omit the ceramic material from the gel electrolyte, because Blonsky teaches that the function of the gelling agent is to absorb the liquid electrolyte in the gel electrolyte

Combination of the references in the manner proposed by the Office does not produce applicants' invention. As discussed above, contrary to the Office position, the electrode of Peled is not a gel. Blonsky does not disclose or suggest an electrode that comprises ceramic material or omitting the ceramic material from his gel electrolyte. Rejection of claims as unpatentable over Peled in view of Blonsky has been overcome.

Extension of Time

A check for a three-month extension of time accompanies this response. Pursuant to 37 C.F.R. § 1.136(a)(3), the Commissioner is requested to treat this Authorization as a constructive Petition for an Extension of Time. A separate Petition for an Extension of Time has not been enclosed. The Commissioner is hereby authorized to charge any additional fee required in connection with this response and to credit any overpayment to Deposit Account No. 18-0350 (Ratner & Prestia).

Conclusion

It is respectfully submitted that the claims are in condition for immediate allowance and a notice to this effect is earnestly solicited. The Examiner is invited to phone applicants' attorney if it is believed that a telephonic or personal interview would expedite prosecution of this application.

Respectfully Submitted,

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LEA/lm

Enclosure: (5) R.I.T.A. Corporation Technical Data Sheets

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The Assistant Commissioner for Patents is hereby authorized to charge payment to Deposit Account No. 18-0350 of any fees associated with this communication.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on:

October 13, 2000
Lawrence E. Ashery